A Contribution towards the systematics of dragonflies of Southern Africa (Odonata)

by

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This communication presents results of studies on the systematics of dragonflies of Southern Africa. It contains descriptions of several new species and subspecies, and remarks on a few other species, where I have been able to supplement or correct the original descriptions. I have paid special attention to the genus *Pseudagrion* Selys, which contains the most species of all African genera. The work on this genus is, in part, a continuation of my previous study of the thoracic structures, as suitable characters for distinguishing the females in this genus (Balinsky, 1957). Two new species of *Pseudagrion* are described: *P. vumbaense*, and *P. umsingaziense*, the latter one belonging to the "*P. nubicum* Selys complex", which seems to deserve special discussion. Some additional data are given on *P. coelestis* Longfield and *P. deningi* Pinhey (1961), and the females of these species are described. In all above species the thoracic structures of the females are described and figured, as well as the thoracic structures of three further species: *P. inconspicuum* Ris, *P. rubroviridis* Pinhey, and *P. sjöstedti* Foerst. A subspecies of *P. angolense* Selys, differing in coloration and occupying a well defined territory is described. The next genus which I found of special interest, is the genus *Agriocnemis* Selys. A new species, *A. pinheyi*, is described, and also a new subspecies of *A. ruberrima* Balinsky. Some details are added to Longfield's (1947) description of *A. angolense*, based on specimens in my collection. Lastly I present here the description of a new species of *Ceratogomphus* Selys from the Western Cape Province.

The specimens on which this communication is based have been collected mostly by myself in recent years. Some specimens have been collected by Mr F. Gaerdes of Okahandja, S.W. Africa, and kindly sent to me for study. I have also examined specimens in the Transvaal Museum.

Genus *PSEUDAGRION* Selys

Pseudagrion vumbaense spec. nov., figs. 1-5

A male and female of this species were taken by the author on a small stream in the Vumba Mountains, east of Umtali, S. Rhodesia. Subsequently

a series of males and females was collected on a small stream on Mount Selinda (S. Rhodesia).

MATURE MALE (colours in life): Labium pale brownish-yellow; labrum black with salad-green anterior edge; genae salad-green with black spot proximally; sides of face salad-green, anteclypeus dark brown, postclypeus black, frons black with whitish pruinosity, top of head velvety-black. Eyes dorsally black, ventrally salad-green. Postocular spots small, ovoid, cerulean-blue. Pronotum black with salad-green edge and a pruinose spot on each side. Synthoracic dorsum black with bluish pruinose antehumeral stripes, the breadth of which is equal to about half to one-third of the dark band on one side of middorsal line. Black band on humeral suture covers most of the mesepimeron and the upper half of the mesinfraepisternum. A black stripe along posterior part of 2nd lateral suture stops just short of the metastigma. The rest of the lateral surface of synthorax salad-green. Legs with femora and tibiae black on lateral surface, light brown on medial surface. Wings hyaline, pterostigma sepia-brown, edged inside the veins with light brown. Abdomen black dorsally, with pruinosity on 1-3, yellowish-green ventrally; 8-9 pruinose dorsally; 10 black. Superior anal appendages black.

IMMATURE MALE: The light colour a yellowish-brown instead of green. A broad transverse light brown band on frons. A light brown line at posterior edge of occiput, not quite reaching the large, pale bluish postocular spots. A light brown instead of a pruinose spot on each side of pronotum. Antehumeral stripes light brown, much broader than in mature specimens, equal in breadth to more than two-thirds of the black band on one side of the middorsal line. Abdomen 8-9 cerulean-blue dorsally, the black of the lateral surfaces invading the blue in the form of narrow tongues just posterior to the middle of each segment; in mature specimens this pattern is obscured by pruinosity.

FEMALE: Labium pale yellowish; labrum mainly salad-green, shaded proximally, and with a yellowish edge; genae salad-green, without spot; anteclypeus salad-green, postclypeus black; frons dark olive-green, vertex black. Eyes as in males. Postocular spots ovoid, cerulean-blue. A faint brownish line on posterior edge of occiput. Pronotum medially black, laterally green, with curved black line. Stylets somewhat variable, short to very short and narrowing towards the ends, green with blackish tip. Thoracic dorsum black with bluish-green antehumeral stripes; the latter reach the humeral suture anteriorly, but leave a black stripe along suture further back. Breadth of antehumeral stripe equal to about half of the black band on each side of middorsal line. Black bands on humeral suture extend over more than half of mesepimeron and over the upper half of mesifraepisternum. Black markings at posterior end of 1st and 2nd lateral suture and at middle of 1st lateral suture. Sides of synthorax salad-green. Legs greenish-yellow with black line on lateral surface of femur; similar line on tibiae reduced to a series of black spots. Wings hyaline, pterostigma light brown. Abdomen

black dorsally, greenish laterally, and yellowish ventrally. Triangular cerulean-blue spots at posterior edge of segm. 8 and 9 dorsally. Segment 10 mainly blue, but with a black elongated spot on each side dorso-laterally.

Superior anal appendages of male (figs. 1, 2 and 3) very much longer than the inferiors, bifid, upper branch is shorter and bears a blunt tooth on its inner surface distally; lower branch much longer, its medio-ventral surface spoon-shaped, slightly concave, the proximal end of this concave part forming a distinct medial protuberance; the proximal unbranched part of appendage bears a large swelling medially. Inferior anal appendages consist of a large rounded proximal part and spoon-shaped distal part. Penis as in figure 4.

The lateral lobe of the mesostigmal lamina of the female has been figured in my previous paper (1957) as that of *Pseudagrion* species near *inconspicuum* Ris. Figure 5 shows the lamina together with adjoining parts. The peculiarity of the present species is that neither the mesostigmal lamina nor the mesinfraepisternum carry a distinctly elevated sclerotized facet for contact with the anal appendages of the male; the mesinfraepisternum is drawn out dorsad to meet the mesostigmal lamina, but is quite smooth; the posterior edge of mesostigmal lamina is thickened, and may perhaps serve for anchoring the appendages of the male.

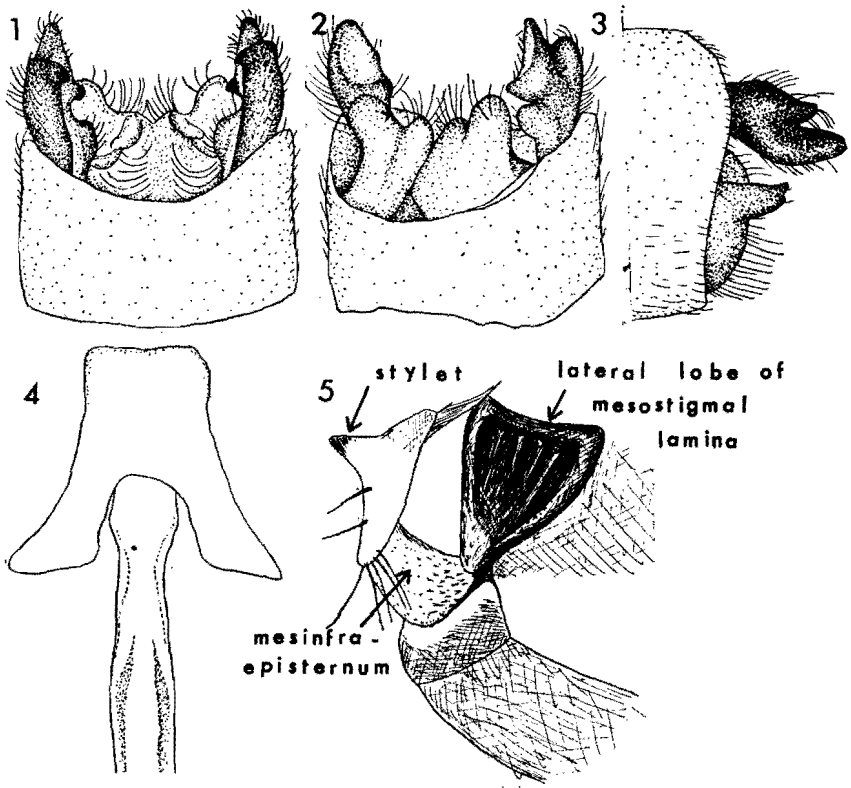
	Abdomen	Hindwing
♂♂	23.5 — 26 mm	16 — 18.5 mm
♀♀	23 — 26 mm	18 — 19.5 mm

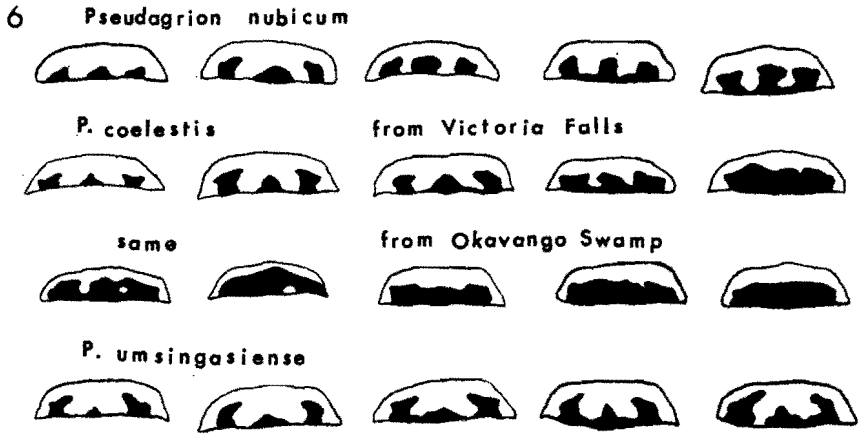
♂ - Holotype: Mount Selinda, 1.I.1956; ♀ - allotype same date and locality, in coll. Transvaal Museum. Paratypes in coll. Transvaal Museum (two ♂♂); in coll. National Museum, Bulawayo (two ♂♂), and in author's collection (six ♂♂, and one ♀). All type specimens collected by author at same date and locality.

REMARKS. The superior anal appendages of the male of *P. vumbaense* are of the same general type as those of *P. inconspicuum*, but in the latter species the ventral branch is cylindrical, without any trace of a medio-ventral concavity or flattening; the median swelling on the proximal part is also lacking in *P. inconspicuum*. The females of the two species are clearly

EXPLANATIONS OF FIGURES

Fig. 1. *Pseudagrion vumbaense*, spec. nov. Anal appendages dorsal view.
Fig. 2. Same, ventro-lateral view.
Fig. 3. Same, view from left.
Fig. 4. *P. vumbaense* spec. nov. Penis.
Fig. 5. *P. vumbaense* spec. nov. Part of ♀ thorax.
Fig. 6. Variations of pattern on postclypeus in *P. nubicum*-group of species (♂♂).





distinct: *P. inconspicuum* having a typical "epaulette" on mesinfraepisternum (see fig. 28), *P. vumbaense* having none. In general *P. vumbaense* is a smaller species, with very distinct greenish colours, which are not found in *P. inconspicuum*. No males and females were taken in copula, the conspecificity rests, apart from general resemblance, on the absence of any other *Pseudagrion* species in the localities where the specimens were taken.

The *Pseudagrion nubicum* complex.

I wish to deal here jointly with several forms which are characterized by the following common features:

a. the light colour in males is a bright blue or greenish-blue, not conceiled by pruinosity in mature specimens;

b. the black pattern on the thorax is moderately extensive, the black band on the humeral suture not straight, but forming a typical pattern, with parts of band mainly below the suture in front, and above the suture posteriorly (see fig. 7);

c. second abdominal segment in male bears dorsally a black forked mark, varying in the length of the prongs of the fork (see fig. 8);

d. superior anal appendages of the males bifid, but terminal incision narrow and not very deep;

e. prothoracic stylets in females shortish, with broadened distal ends;

f. mesinfraepisternum in females unmodified (Balinsky, 1957), but a facet for the contact with the male anal appendage is formed by the latero-ventral tip of the mesostigmal lamina.*)

The best known species of this group is *P. nubicum* Selys. I have been able to examine specimens of this species collected in S. Rhodesia, in the Salisbury area (by Mr E. Pinhey and by myself) and in the Victoria Falls area (collected by myself, previously recorded by Pinhey, 1961). There appears to be no doubt about the classification of these specimens — they agree satisfactorily with descriptions by Selys (1876), Ris (1936) and Schmidt (1947-1949).

Two further species of this group occur in Southern Africa. The first to be mentioned is *P. coelestis*, described by Longfield (1947) from two males, collected in S. Angola. This species was recorded by Pinhey (1961) from the Victoria Falls area, and was also collected by myself in the same locality

* When writing this paper (1957) I was unaware that Schmidt (1947-1949) already paid attention to the thoracic structures of females in the genus *Pseudagrion*, and used them, together with other characters, in compiling a key for the females of this genus. In particular he has figured the mesostigmal lamina of *P. nubicum* (his fig. 12c) in a way similar to my own findings. Schmidt's paper escaped my notice at the time, and it gives me pleasure to acknowledge here his priority.

and in the Okavango Swamp (Bechuanaland). I have examined a male from the Victoria Falls, identified as *P. coelestis* by Pinhey, and I am satisfied that my material is conspecific.

P. coelestis has been described by Longfield as "an exceedingly blue insect, with very little black marking" and with the black humeral stripe narrow and broken in the centre. Pinhey himself (1961) in the key for *Pseudagrion* males subdivided them into two main sections:

A. in which the thorax is more or less black, the antehumerals, if present, being not more than half the width of each mesepisternum;

B. in which the thorax dorsally is mainly pale coloured (red, blue, green) the medial and humeral black being narrow.

According to Pinhey's key *P. nubicum* belongs to section A, *P. coelestis* to section B. Furthermore, *P. nubicum* is characterized as having a black U-shaped mark on 2nd abdominal segment, *P. coelestis* as having a mark like a cat's head on the same segment.

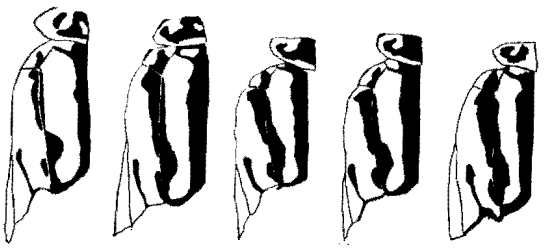
In figure 7 I present camera lucida drawings of the thoracic pattern and in figure 8 the pattern on the 1-2 abdominal segments of *P. nubicum* and of the Victoria Falls — Okavango Swamp species (as well as of a third species to be dealt with later). It is obvious that the patterns are practically identical, with a wide variation which is overlapping. The population from the Okavango Swamp is, if anything, the darkest of all. In all populations the "cat's head" pattern represents the extreme light variation, and the U-shaped mark represents the darker form. It is possible, therefore, that the two male specimens, on which Longfield's description of *P. coelestis* was based, might have been extreme light variants of the species in question, and that therefore her description would not cover the range of variation of the species as a whole. I am offering here a redescription of the species. Longfield did not have any females of *P. coelestis*. I am able to supplement her description also in this respect, as I have collected a number of females, obviously belonging to the same species as the males classified as *P. coelestis*.

Pseudagrion coelestis Longfield, figs. 9-13

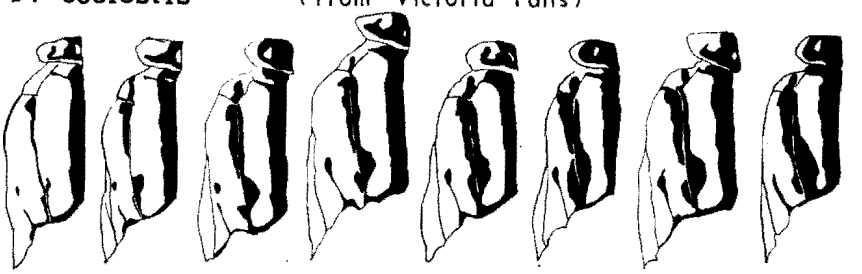
Redescription based on Rhodesian and Bechuanaland populations.

MALE: Labrum greenish-blue with small black spot at base; genae, sides of face, anteclypeus, a broad band across the frons and a stripe on posterior edge of occiput greenish. Postclypeus greenish with three black spots at base, which are often fused in a single broad spot (fig. 6). Eyes greenish-blue, black dorsally. Top of head velvety black. Postocular spots large, subtriangular, greenish-blue. Prothorax black with greenish-blue lateral edge, similar coloured two pairs of spots (which are reduced or completely absent in darker specimens), and blue markings at posterior edge. Thoracic dorsum with black bands along the midline and on humeral suture, and with broad

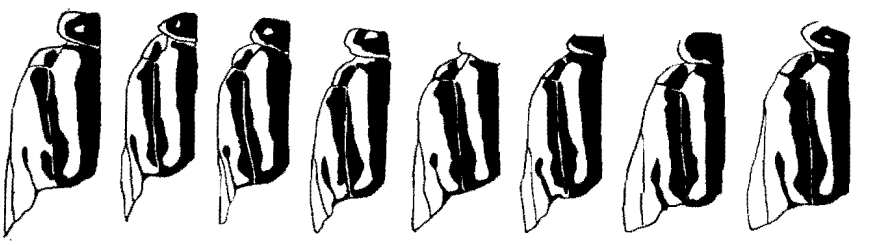
Pseudagrion nubicum



P. coelestis (from Victoria Falls)



(from Okavango Swamp)



P. umsingaziense

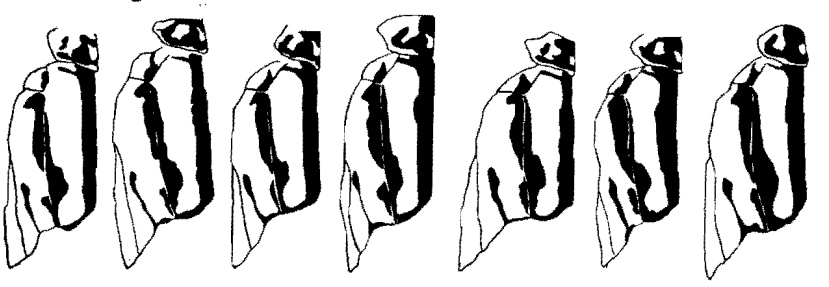


Fig. 7. Variations of pattern on thorax in *P. nubicum*-group of species (♂♂).

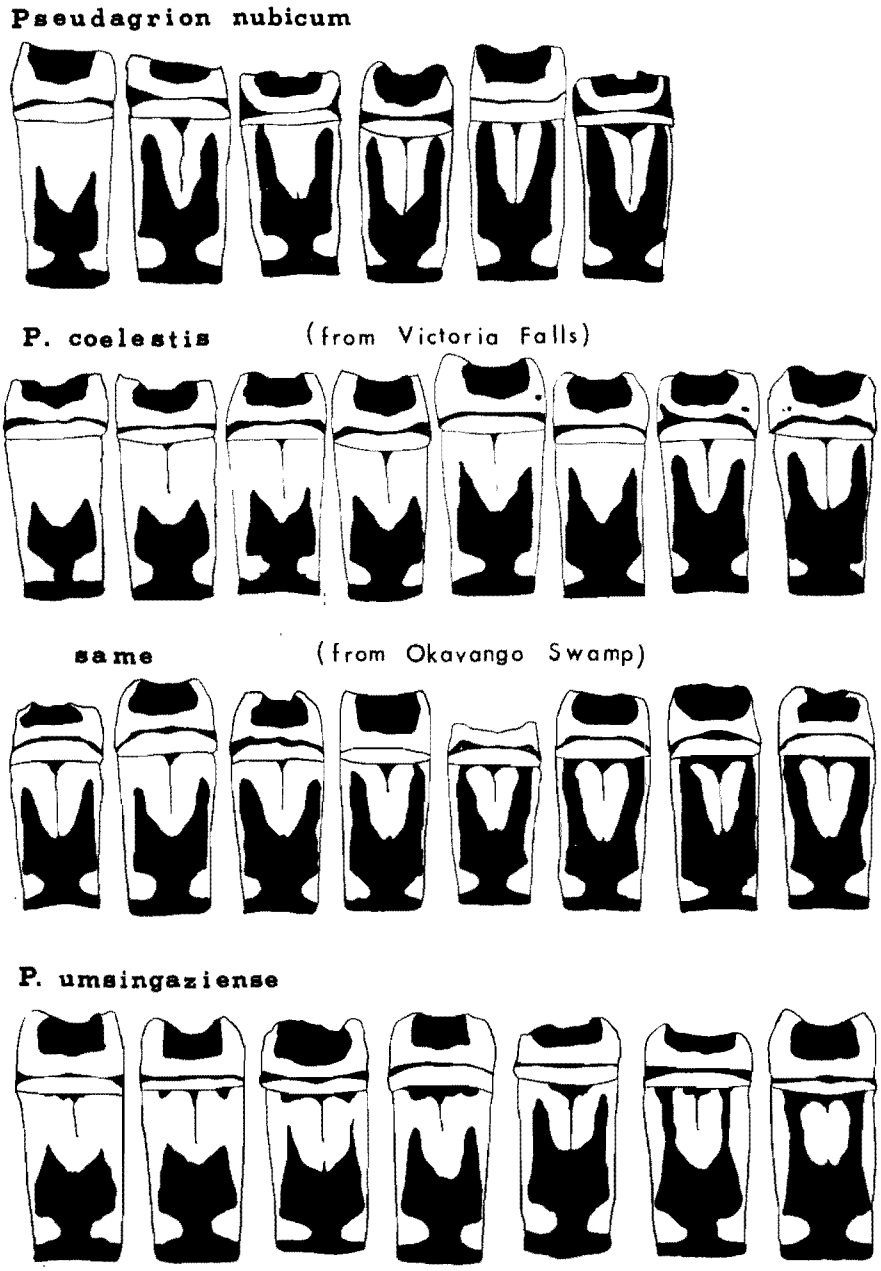


Fig. 8. Variations of pattern on 1 and 2 abdominal segment in *P. nubicum*-group of species (♂ ♂).

greenish-blue antehumeral stripes; breath of antehumeral stripe varies from being about equal to the black area on one side of the middorsal line, to being about three times that width. Humeral black band of irregular shape, expanding anteriorly more on to the mesepimeron, and on to the mesinfra-episternum, and posteriorly expanding on the mesepisternum (fig. 7). In extremely light coloured specimens this band may be interrupted in the middle. A black stripe on the posterior half of the 1st lateral suture, and a black mark on posterior end of 2nd lateral suture. Side of thorax cerulean-blue. There is no pruinosity. Legs bluish to yellowish, black on extensor surface of femora. Wings hyaline, pterostigma violettish-brown. Abdominal segments 1 and 2 cerulean-blue, 2 with fork-shaped black mark dorsally, varying in degree of development from a reduced "cat's head" shape, to a complete fork with prongs reaching anterior end of segment and enclosing a heart-shaped blue spot (fig. 8); 3-7 black dorsally, greenish-blue laterally; 8-9 cerulean-blue; 10 black dorsally, blue on sides, superior anal appendages black with blue medial surface.

FEMALE: Face mainly olivaceous, black markings: spot at base of labrum, three spots at base of postclypeus, tending to fuse, as in males, semilunar spot on frons. Black band across vertex, including ocelli, eyes greenish-blue, brown dorsally. Postocular spots greenish-blue, nearly but not quite fused with greenish stripe along posterior edge of occiput. Prothorax black medially, but with extensive olivaceous markings. Prothoracic stylets shortish, broadened towards tips, light coloured but darkened at tips. Synthoracic dorsum with pattern similar to the most light coloured males, olivaceous antehumeral stripe taking up most of the mesepisternum, twice to almost four times as broad as median band on one side of middorsal line. Humeral stripe mainly on mesepimeron anteriorly, passing on to mesapisternum posteriorly. Legs light greenish-brown, with dark stripes on external surface of femora. Wings hyaline, pterostigma fawn. Abdomen broadly black dorsally, olivaceous laterally, segments 8-10 cerulean-blue, but 8 with large black area dorsally, tapering towards posterior end, 9 with two confluent black triangles proximally.

Superior anal appendages of male bifid, only slightly longer than inferiors (figs. 9 and 10); upper branch slightly shorter, with a few short strong spines on tip, and with a short strong tooth on medial side distally, pointing in a medio-ventral direction; lower branch bluntly conical at tip, broadening proximally in a medio-ventral direction and forming a protruding angle at about two-fifths distance from tip. Proximally to angle the appendage becomes narrower, and its medial surface is membraneous. In some specimens there is a tiny black tubercle on medio-ventral edge of superior anal appendages, at about one-fifth length from its base. Inferior anal appendages spoon-shaped, with a hairy lobe dorso-medially. Penis (figs. 11 and 12) with moderately elongated "head", deeply incised, the lateral flaps with a slight fold on lateral edge, narrowing towards the tips, which end close to the shaft of the penis.

The thoracic structure of the female is of the same general type as in

P. nubicum, the mesinfraepisternum is not modified, but a facet is formed by the latero-ventral extension of the mesostigmal lamina, which bears a strong black ridge (fig. 13). The only difference is, that in *P. nubicum* the posterior flange of the sclerotised facet is quite smooth, whereas in the present species there is a slight fold posterior to the main ridge, joining the main ridge just after the first quarter of its length (from tip of lamina). The difference, though slight, is consistent in the material which I have studied. The part of the mesostigmal lamina anterior to the ridge is membraneous.

	Abdomen	Hindwing
♂♂	24.5 — 27.5 mm	16.5 — 18 mm
♀♀	24 — 26 mm	17.5 — 19 mm

From this description, and especially from figures 6, 7 and 8, it is obvious that *P. coelestis* (if the Rhodesian and Bechuanaland populations actually belong to this species) cannot be held apart from *P. nubicum* on the basis of coloration. The differences that can serve for the distinction of the two species are their structural features, and in particular the structure of the male superior anal appendages. The superior anal appendages of *P. nubicum* as described by Selys (1876) and as figured by Ris (1936) possess sharp tooth (according to Ris two teeth) on the medio-ventral edge. Such a tooth or teeth are absent in *P. coelestis;* instead there is present the aforementioned blunt protrusion, which is, however, situated more distally. There is also a distinct difference in the structure of the penis: the head of the penis of *P. coelestis*, as figured by Longfield, and as shown in my own figs. 11 and 12, is deeply incised, whilst the penis of *P. nubicum*, as shown in Schmidt's fig. 6, f and g (1947-1949), has a very shallow incision, and the shapes of the lateral "flaps" are quite different. The penis in my specimens of *P. nubicum* from Rhodesia conforms to Schmidt's figure. The difference in the females of *P. coelestis* and *P. nubicum* was noted above.

Pseudagrion umsingaziense spec. nov., figs. 14-18

This second and larger and lighter coloured species belongs to the same group.

MATURE MALE (colours in life): Face all bright salad-green with very few black markings, namely: small spot at base of labrum, three spots at base of postclypeus (fig. 6), semilunar spot on frons. Broad black band across top of head. Eyes with blackish sector on top, otherwise salad-green. Postocular spots very large, triangular, bright bluish-green, separated by black from posterior of head and from a bluish-green bar on posterior edge of occiput. Prothorax salad-green with black markings. Synthoracic dorsum (fig. 7) with black bands along midline and humeral suture, the latter band

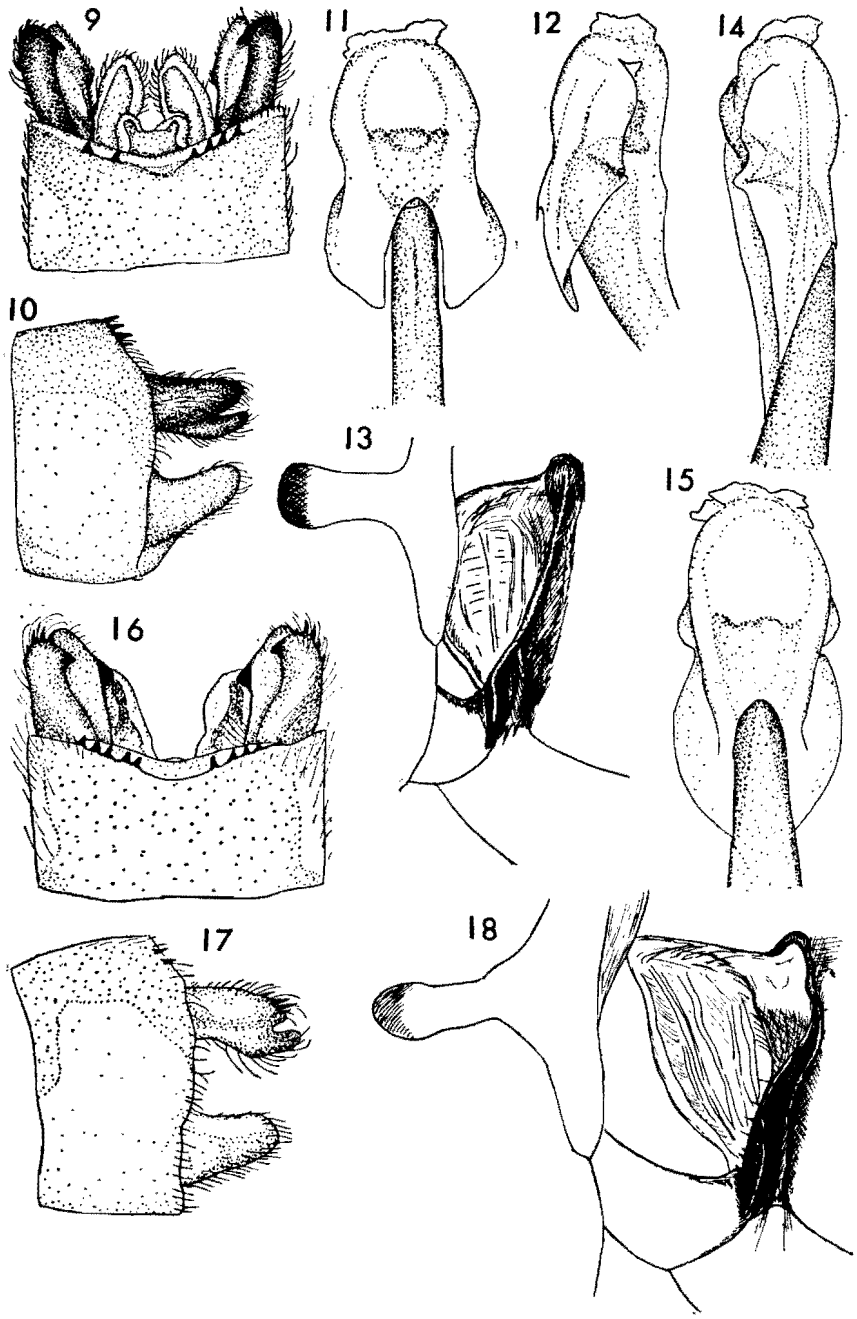
curved, so that anteriorly it is mainly ventral, posteriorly mainly dorsal of the humeral suture; black line or dot on posterior half of 1st lateral suture, black mark on posterior end of 2nd lateral suture. Antehumeral stripes broad, more than twice the breadth of black band on one side of middorsal line, bright salad-green. Sides of thorax azure-blue, ventral surface buff. There is very little or no pruinosity. Femora with black extensor surface and greenish flexor surface, tibiae and tarsi brown. Wings hyaline, pterostigma sepia-brown, surrounded inside the veins with light brown. Abdomen: segments 1-2 and sides of 3 proximally azure-blue; 2 dorsally a black forked spot, the prongs of the fork varying, apparently independently of the age of the specimen, from the short "cat's head" type to the condition where the prongs reach anterior edge of segment, isolating a heart-shaped blue spot in the middle (fig. 8); 3-7 black dorsally, olive-green on sides, 8-9 azure-blue; 10 black dorsally, blue on sides. Superior anal appendages black, but with blue medial surface.

Juvenile male. All light parts violettish-grey, even the 8-10 abdominal segments.

FEMALE: The light colour is salad-green to olive-green, sides of thorax and abdominal segments 8-10 light blue. Black markings on head and thorax of the same type as in the male but further reduced in varying degrees. Black band across top of head broken up in a series of spots. Postocular spots may or may not be connected to green bar across posterior edge of occiput. Prothoracic stylets shortish, broadened towards the tips, light with darkened tips. Black bands on thoracic dorsum narrower, band on humeral suture extremely attenuated or even interrupted in the middle; antehumeral stripes about six times as broad as the black areas to one side of middorsal line. Legs ochreous, black bands on femora reduced to rows of partly confluent dark spots. Wings hyaline, pterostigma yellowish-brown. Abdomen with black band dorsally on 2-8, greenish laterally. Black markings on 2 not fork shaped but solid, broadening posteriorly and again narrowing

EXPLANATIONS OF FIGURES

Fig. 9. *Pseudagrion coelestis* Longfield. Anal appendages, dorsal view.
Fig. 10. Same, view from left.
Fig. 11. *P. coelestis* Longfield. Penis, ventral view.
Fig. 12. Same, view from right.
Fig. 13. *P. coelestis* Longfield. Part of ♀ thorax.
Fig. 14. *Pseudagrion umsingaziense* spec. nov. Penis from left side.
Fig. 15. Same, ventral view.
Fig. 16. *P. umsingaziense* spec. nov. Anal appendages, dorsal view.
Fig. 17. Same, view from left.
Fig. 18. *P. umsingaziense* spec. nov. Part of ♀ thorax.



abruptly before joining the terminal black ring. Black band on 8 tapers gradually, but reaches posterior edge; dorsum of 9 mainly blue, but with two confluent black triangles proximally; 10 completely blue.

The superior anal appendages of male only slightly longer than inferiors, bifid, incision at end narrow and not very deep (figs. 16 and 17); upper branch distinctly shorter than the lower branch, bears a number of very strong and long spines on the tip, and a short strong tooth on the medial side distally; the tooth is not always easy to see due to hairyness of the appendage. Lower branch with blunt end, widening proximally and with a large blunt tooth on inner margin, proximal of the tooth on upper branch, but well distal of half the length of appendage as a whole. Medial surface of appendages membraneous and without hairs. Inferior anal appendage spoon-shaped, with a hairy lobe dorsomedially. Penis (figs. 14 and 15) has a very elongated "head", which is deeply excised, the lateral flaps running out into long pointed tips, and forming distinct outwardly directed folds proximally.

In the female the mesinfraepisternum is not modified, a facet being formed by a latero-ventral extension of the mesostigmal lamina which bears a strong black ridge, as in *P. nubicum*. The posterior flange of this ridge is not smooth, as in *P. nubicum*, but bears a second, lower ridge. The latter does not fuse with the main ridge, as in *P. coelestis*, but is continued to the postero-dorsal angle of the mesostigmal lamina, whilst the main ridge is smoothed out at about two-thirds length from lateral end of lamina (fig. 18). This part of the mesostigma lamina anterior to main ridge is membranous.

	Abdomen	Hindwing
♂♂	28.5 — 30 mm	18 — 19.5 mm
♀♀	28 — 30 mm	19 — 21 mm

♂ - Holotype: Richard's Bay (Natal), 23.XII.1959; ♀ - allotype same locality, 30.XII.1957, in coll. Transvaal Museum. Paratypes in coll. Transvaal Museum and in author's collection (seven ♂♂ and five ♀♀, XII.1957, three ♂♂ and two ♀♀, XII.1959). All type material collected by author from same locality.

REMARKS: This seems to be a very local species, very abundant on Umsingazi Lake, Richards Bay; collected also on Enzeleni River, a few miles further south.

Lastly in this section I should like to mention a peculiar discovery made on Lake Kariba. In December 1961 two males were taken on the lake which apparently are *P. nubicum*, but differ from those collected in adjacent parts of the Rhodesias. A further male of the same kind was caught in July 1962.

Pseudagrion nubicum forma (?). With three or four teeth on inner margin of superior anal appendages (fig. 19). Ris (1936, fig. 9) depicts the superior anal appendages of *P. nubicum* (from Fayum) as having two sharp

teeth on the inner margin, however the common condition in Southern African specimens is to have only one very distinct tooth in the position of the anterior tooth of Ris' figure. All specimens from the Salisbury area in the Transvaal Museum and my collection, as well as a specimen from Victoria Falls area are very uniform in this respect.

It is further of interest, that during two collecting trips to Kariba Lake (in September 1959 and in April 1960) no *P. nubicum* specimens were taken, neither were any seen, although the species is rather conspicuous due to its bright blue colour. In 1961 the insects, though not actually abundant, were seen repeatedly. It would appear that the species has markedly increased on the lake, if not colonized it afresh. One of the specimens was taken on a patch of floating "sud", which has developed in the lake since it was filled in 1959. The specimen was extremely teneral and must have emerged from a nymph living on the sud. It seems plausible, therefore, that the spreading of the species on the lake is somehow connected with the development of the sud. As the species was not found on the lake in 1959-60, it would seem that an actual invasion must have taken place after that time, at least in respect of the area where my observations were made (in the part of the lake adjoining Binga). The most plausible suggestion, namely, that the species has invaded the lake from the upper reaches of the Zambezi, via Victoria Falls, together with the water fern, *Salvinia,* which causes sud formation, is in contradiction with the fact that the species is represented at the falls by another form (with one tooth). For the same reason the species could not have invaded the lake from the east, from the S. Rhodesian highlands. It may be suggestive, that the Kariba Lake form bears the greatest resemblance to the form from northern Africa, as it was figured by Ris (l.c.).

Pseudagrion deningi Pinhey, 1961, figs. 20-25

The species has been described from a single male specimen taken in Bangweulu swamps, Northern Rhodesia. The type was probably in a poor condition, thus accounting for the very unsatisfactory drawing illustrating the description. In Pinhey's paper, fig. 2b, the superior anal appendages in dorsal view are shown as fusing in the midline, which of course cannot be correct. During a collecting trip to the Okavango Swamp in April 1962 I have taken a number of specimens, which fit the description of Pinhey's *P. deningi.* An examination of the superior anal appendages of my specimens shows that these have a very conspicuous tooth on their lower margin, which is not shown or mentioned in Pinhey's paper. I therefore include here drawings of the anal appendages of this very remarkable species (figs. 20 and 21), and also a drawing of the penis, not figured by Pinhey (figs. 22 and 23); the latter is remarkable for its very small "head". Together with the males I have collected a number of females obviously of the same species. As Pinhey did not describe the female of his *P. deningi,* I am able to give here the following brief description:

Very dark insect, as the male, without postocular spots, without antehumeral

stripes, but small lighter coloured (brown) spots present at upper end of mesepisternum in some specimens, perhaps as remnants of an antehumeral stripe. Dorsal black extends to the upper half of mesepimeron; black stripe on posterior half of 1st lateral suture, and a complete black stripe on 2nd lateral suture. Sides of thorax buff, underside yellow. Abdomen black dorsally, to proximal half of segment 8 inclusive; black baso-lateral spots on 9; rest of 8, 9 and 10 purplish-blue. The insect is very hirsute (as also the male). Pronotum without stylets, posterior edge shaped in three rounded lobes (fig. 24). Mesinfraepisternum unmodified, lateral lobe of mesostigmal lamina bears on its posterior edge a very high ridge, curved towards the rear and slanting in the same direction (fig. 25).

Thoracic structure in females of some other species of *Pseudagrion*

P. inconspicuum Ris, fig. 28

Specimen examined: female taken in copula on Great Berg River, near Franschhoek (C.P.). The mesinfraepisternum (fig. 28) forms a typical "epaulette" which is closely applied to the angle of the mesostigmal lamina. The preespisternum does not form a swelling at the junction with the mesostigmal lamina, and does not bear strong spines at this point, only some fine short hairs. The lateral lobe of the mesostigmal lamina is flat, with thickened edges, but without a distinct ridge. All these features the female of *P. inconspicuum* has in common with the female of *P. kersteni* Gerst., described in my previous paper. The females of these two species are, so far as I can see, indistinguishable by their thoracic structures. As the anal appendages of the males in the two species are very similar, they must be considered as being very close to each other indeed.

P. rubroviridis Pinhey, fig. 26

Specimens examined: numerous females collected on the Limpopo and

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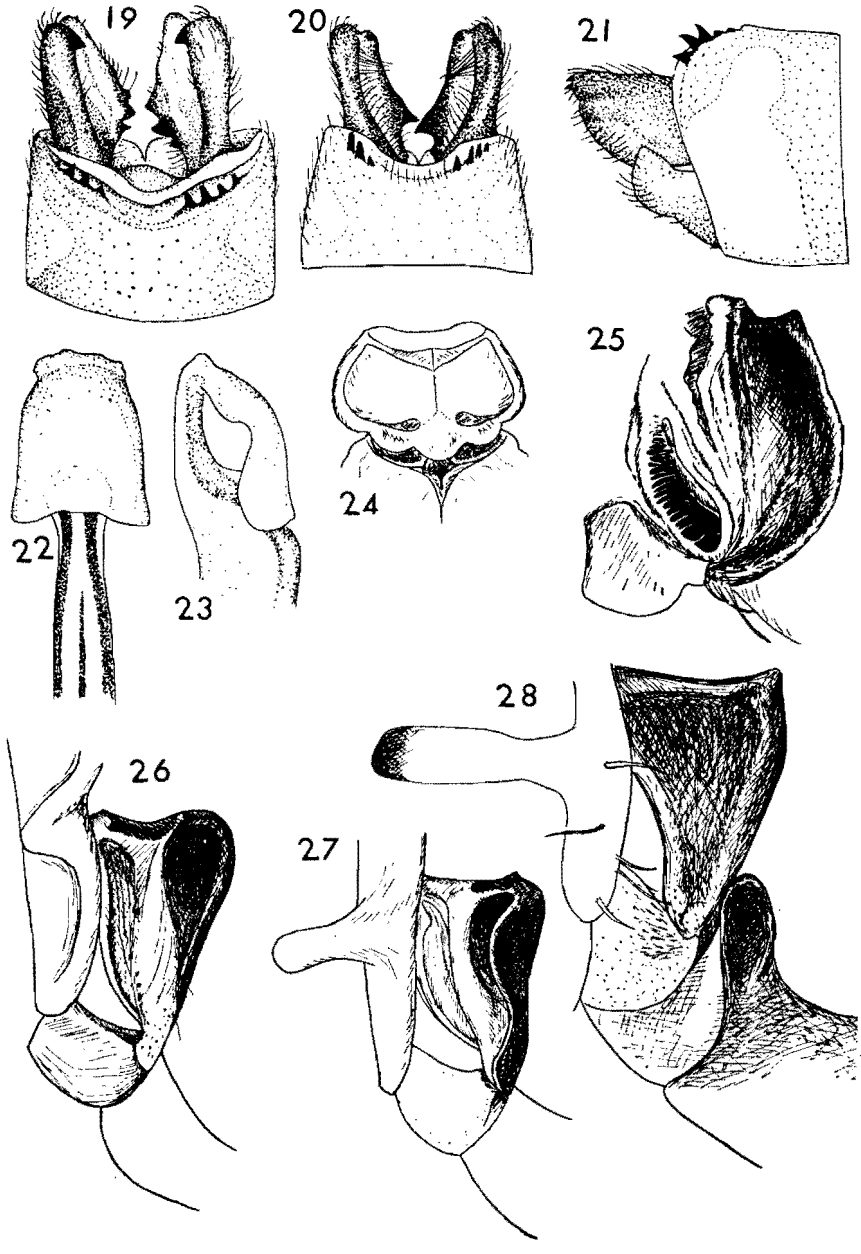
EXPLANATIONS OF FIGURES

Fig. 19. *Pseudagrion nubicum* Selys from Lake Kariba. Anal appendages, dorsal view.
Fig. 20. *Pseudagrion deningi* Pinhey. Anal appendages, dorsal view.
Fig. 21. Same, view from right.
Fig. 22. *P. deningi* Pinhey. Penis, ventral view.
Fig. 23. Same, view from left.
Fig. 24. *P. deningi* Pinhey. Prothorax of ♀.
Fig. 25. *P. deningi* Pinhey. Part of ♀ thorax with lateral lobe of mesostigmal lamina.
Fig. 26. Part of thorax with lateral lobe of mesostigmal lamina of *Pseudagrion rubroviridis* Pinhey.
Fig. 27. Same in *Pseudagrion sjöstedti* Först.
Fig. 28. Same in *Pseudagrion inconspicuum* Ris.



on the Zambezi, from Victoria Falls to Lake Kariba, four pairs taken in copula. The mesinfraepisternum is not modified. The lateral lobe of the mesostigmal lamina bears a thick ridge running along its middle (fig. 26). The ridge is mainly light coloured. The greatest breadth of the ridge is in the outer half of its length. Posterior to the upper (inner) end of the ridge there is a deep strongly sclerotised, intensely black fossa. Another fossa, which is, however, not so strongly sclerotised, lies anterior to the ridge. If my key (1957) is used, this species would be grouped together with *P. massaicum* Sjöstedt, from which it can be easily distinguished by the ridge being straight and not bent at an angle, and by the fossae on both sides of the ridge, the posterior fossa being especially conspicuous.

P. sjöstedti Först, fig. 27

Specimens examined: two females taken at Katambora, near Victoria Falls, one of them in copula. The mesinfraepisternum is not modified. The lateral lobe of the mesostigmal lamina bears two ridges, which fuse laterally, but are separated proximally by a deep, moderately sclerotized fossa lying between them (fig. 27). The anterior ridge is not strongly sclerotized, broad and rounded at the top. The posterior ridge is narrow, sharp, black, and very strongly sclerotized; it is curved forwards, and in this curve lies a deep pitch black strongly sclerotized fossa, which also extends laterally along the fused posterior portion of the ridges. In my key (1957) this species would come nearest to *P. assegai* Pinhey and *P. nigerrimum* Pinhey, but could be distinguished from both by the double ridge on the mesostigmal lamina.

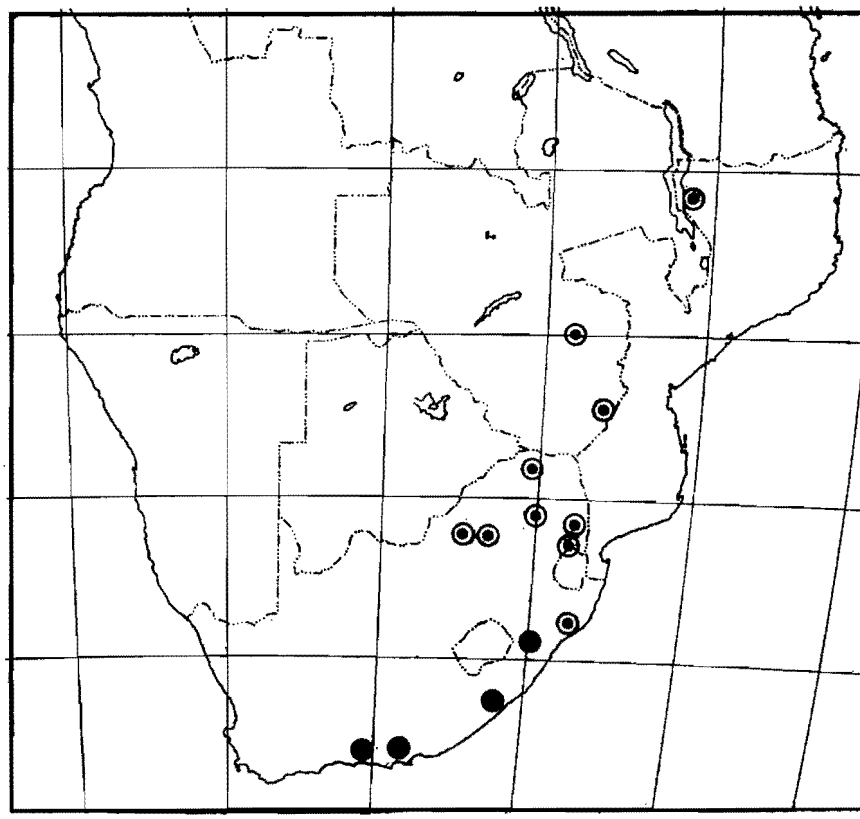
Pseudagrion angolense Selys, fig. 29

Selys (1876) described the light colour in the males of *P. angolense* as "yellow". Ris (1921, 1936) stated that the antehumeral stripes of this species are "greenish". Pinhey (1951) writes that the antehumeral stripes in *P. angolense* are "pale greenish to greenish-orange". The earlier authors, except Pinhey, had at their disposal only preserved and to various extents discoloured material. On my own collecting trips I have noted that there exist two distinct varieties of *P. angolense:* one with green antehumeral stripes and the other with brick-red antehumeral stripes. In any one locality all specimens are of the same colour, and there appear to be no gradations. In preserved specimens the colours fade, but may still be told apart. On the other hand the anal appendages of the males are indistinguishable, and so are also the thoracic structures of the females. I propose therefore to regard the "red" form as a separate subspecies. The "green" form is obviously the nominotypical one, both because the older authors (especially Ris) describe the colour of the antehumeral stripes as greenish, and because Selys' type came from Angola, which is not in the area of distribution of the "red" form (see below).

Pseudagrion angolense rubridorsum subsp. nov.

In structural characters similar to nominotypical form of *P. angolense* Selys. The light coloured areas on head, prothorax, and thoracic dorsum of the males brick-red in life, fading to orange in preserved specimens. Sides of thorax orange. Reddish-orange colour also present on sides of abdominal segments 1-3; 8-9 violet-blue, as in nominotypical form. In females no differences from nominotypical form.

♂ - Holotype: Port St. Johns, 28.XII.1956; ♀ - allotype: same locality and date, in coll. Transvaal Museum (collected by author).



◉ *P. a. angolense*

● *P. a rubridorsum*

Fig. 29. Map showing distribution of two subspecies of *Pseudagrion angolense* Selys.

Distribution (unless otherwise stated, based on author's collecting and field observations) (see also map, figure 29):
P. a. rubridorsum: Groot River, near Plettenberg Bay (C.P.); van Stadens Pass (C.P.) (Transvaal Museum); Port St. John's (C.P.); Umgeni River near Howick (Natal).
P. a. angolense is the form occurring in the following localities in Southern Africa: Richards Bay (Natal); Barberton (Tvl.); Sabie River (Tvl.); Mecklenburg Farm, Sekukuniland (Tvl.); Kings Kloof, near Johannesburg (Tvl.); Crystal Waters, Magaliesberg (Tvl.); Fountains, in Pretoria (Tvl.) (Transvaal Museum); Happy Rest, Zoutpansberg, west of Louis Trichardt (Tvl.); Salisbury (S. Rhodesia) (Transvaal Museum); Mt. Selinda (S. Rhodesia); Lake Nyasa, west of Vila Cabral (Moçambique).

The nominotypical form is thus distributed over Northern Natal, Transvaal, S. Rhodesia, Moçambique, and presumably over parts of Africa further north and north-west (Angola-Selys!). *P. angolense rubridorsum* is endemic in the western part of the Cape Province and southern half of Natal. The borderline between the distribution areas of the two forms passes between Umgeni River and Richards Bay. It is remarkable that the population on the Umgeni River is peculiar in its minute size. Only one specimen was captured in this locality, but two others were seen, one in a different season, and all were equally small; they appear to represent a special local race.

	Abdomen	Hindwing
P. a. rubridorsum		
Groot River population	29.5 — 31 mm	20 — 20.5 mm
Port St. Johns population	32.5 — 34.5 mm	22.5 — 23 mm
Specimen from Umgeni River	25 mm	18.5 mm
P. a. angolense in S. Africa	32 — 38.5 mm	21 — 24.5 mm

Genus *AGRIOCNEMIS* Selys

In his capital work on S. African Odonata Pinhey (1951) referred all specimens of *Agriocnemis* at his disposal to the species *A. exilis* Selys. He distinguished several forms of this dragonfly: form "a", the typical form, variety A of this form, form "b" (from Salisbury and Moçambique), variety B of this form, and form "c" from Zululand. None of the drawings in his book actually depict a genuine *A. exilis* as understood by previous writers (Le Roi, 1915; Ris, 1921; also by Fraser, 1954 — the original description by Selys is incomplete, as the type lacked the last abdominal segments). This can be clearly seen when Pinhey's drawings of the anal appendages of the male (figs. 307-310) are compared with the drawings of the abovementioned authors.

Subsequently Pinhey described his form "c" from Zululand as a new species *A. falcifera* Pinhey (1959). Although the latter paper was specially devoted to a revision of the African species of the genus, no further mention was made of the "Salisbury and Moçambique" form. After an examination of the specimens which were in Pinhey's hands (now in the Transvaal Museum), and of the abundant material in my own collection, I have become convinced that the "Salisbury form" of Pinhey is a distinct new species, which I now name in honour of Mr E. Pinhey, who first paid attention to this form, though he failed to reach a decision as to its taxonomic standing.

Agriocnemis pinheyi spec. nov., figs. 30-32, 35-37 (= *A. exilis* Pinhey part., 1951, non *A. exilis* Selys)

Very close to *A. falcifera*, but is distinguished by a number of characters: it is a smaller species, the ventrally directed lobe of the superior anal appendage has a differently shaped end, the inferior anal appendages are shorter, and their tips not as distinctly serrated as in *A. falcifera*, pterostigma in the fore and hind wings is of the same colour, not darker on the hind wings, as in *A. falcifera*, the shape of the posterior edge of the prothorax in the female is different. From *A. exilis* the present species is easily distinguishable by the absence of the medio-ventrally directed spine on the superior anal appendages of male.

MATURE MALE (colours in life): Labrum black with a slightly bluish sheen, anterior edge narrowly fringed with green; anteclypeus, genae, sides of face and broad bar across anterior edge of frons green. Postclypeus, most of frons and vertex black. Eyes green, but black dorsally, differently coloured areas sharply divided. Postocular spots green, very small, oval, very laterally situated, completely isolated. Narrow green line on posterior edge of occiput. Rear of head greenish-yellow. Prothorax black above, with two small green transverse spots anteriorly, and green lateroventral edges. Posterior edge of prothorax subdivided into three lobes: median lobe by far the largest, subrectangular, with upturned corners (fig. 35); lateral lobes narrow and rounded. Posterior edge of medial lobe with narrow green margin, similarly the outer part of the lateral lobes. Synthorax black to 1st lateral suture and on upper half of mesinfraepisternum. Antehumeral stripes green, narrow, less than one-fifth of the black median band on one side of middorsal line. In some specimens the antehumeral stripe is interrupted in its posterior quarter. Sides of synthorax green, underside yellowish. Legs yellow, femora with black stripe on extensor surface, abruptly broadened at distal end; black spot on distal end of 3rd tarsal segment. Wings hyaline, pterostigma light brown. Abdominal segments 1-6 broadly black dorsally and green on sides; 7 black dorsally and red on sides, 8 mainly red, but with narrow black median stripe; 9-10 pure red, but in some specimens a narrow median black line is continued on 9. In some specimens the red on sides of abdomen starts more proximally, at the expense of green. Anal appendages red.

FEMALE homochromatic: Head similar to male, but with labrum dark brown instead of black, and the eyes dark ferruginous on upper surface; no postocular spots. Rear of head greenish-yellow. Prothorax with the same markings as in male, but the light colour is ochreous-yellow instead of green. Posterior edge of prothorax not distinctly subdivided in three lobes, but the median part protrudes backwards beyond the level of the rest of the edge; there is a distinct furrow along the middle of this protruding part (fig. 36). Synthorax black to just beyond the humeral suture. Antehumeral stripe ochreous, the same width as in the male, and also interrupted in some specimens. Sides of thorax ochreous. A black spot at upper end of 1st lateral suture. Legs as in male. Pterostigma ochreous. Abdominal segments 1-6 black above, green on sides, yellowish ventrally; 7-10 black extended further laterally and green reduced in varying degrees. Anal appendages rufous.

FEMALE heterochromatic: Labrum bright yellow, genae, anteclypeus, and sides of face pale yellow; postclypeus and upper surface of head dark brown. Bar across anterior edge of frons orange. Postocular spots orange very large, not surrounded by black posteriorly, joined by a stripe across occiput. Prothorax brown dorsally and orange on sides. Posterior edge of prothorax orange, shaped as in homochromatic female. Synthorax dark brown to just beyond humeral suture. Antehumeral stripes broader than in male, equal to one-quarter to one-third of the dark band on each side of middorsal line. Sides of thorax orange. Legs yellow, without dark stripes. Abdomen mainly reddish, segment 2 with dark marking middorsally; 3-6 with very thin dark median line and dark rings at ends; 7-10 with broad dark bands dorsally. Sides red to 7th segment inclusive, brownish in 8-10. Anal appendages reddish-brown.

Superior anal appendages of male slightly longer than inferiors, have a short club-shaped main part, which bears a large deep depression latero-caudally; posteriorly the appendage is inflected in the form of a broad flattened lobe, directed downwards and somewhat inwards; the free edge of the lobe is rounded and strongly sclerotised, without, however, forming a tooth or spine (figs. 30, 31 and 32). Inferior anal appendage roughly conical, with apex slightly bent upwards and ending in a short transverse sclerotized ridge. The structure of the anal appendage is very similar to that of *A. falcifera*, but in the latter species all parts are longer, the ventrally directed flattened lobe of the superior anal appendage in *A. falcifera* ends in a triangular pointed tooth (fig. 33) instead of being rounded, as in *A. pinheyi;* the tips of the inferior anal appendage tend to be roughly serrated in *A. falcifera* (fig. 34), whilst in *A. pinheyi* the serration is hardly noticeable. The penis is shown in figure 37; the flaps lying on both sides of the shaft are bent upwards almost at right angles to the rest of the "head", this cannot be seen in the drawing.

In *Agriocnemis* the two sexes are very rarely seen in copula, and I have seen none in this species; that the males and females described above are conspecific, may be concluded from the fact that I collected them together in three different localities where no other species of *Agriocnemis* were present.

			Post nodal cross veins	
	Abdomen	Hindwing	Forewing	Hindwing
♂♂	14 — 16.5 mm	8 — 9.5 mm	6 — 8	4 — 6
♀♀	15 — 18 mm	10 — 12 mm	6 — 9	5 — 7

♂ - Holotype: Blairgowrie, Johannesburg, 21.III.1954; ♀ - allotype, same locality and date (both collected by author) — in coll. Transvaal Museum. Paratypes in Transvaal Museum, listed as *P. exilis*, Salisbury and Moçambique form in Pinhey (1951). In authors collection: one ♂, three ♀♀ Johannesburg (Tvl.), III.1954 and II.1955; 15 ♂♂, nine ♀♀, Haenertsburg (Tvl.), XI.1955; five ♂♂, four ♀♀, Moorddrif near Potgietersrus (Tvl.) XI.1955.

Agriocnemis ruberrima Balinsky, 1961

This species was described by myself from Richard's Bay (Natal); two ♂♂ and five ♀♀ collected recently in the Okavango Swamp appear to represent a different subspecies of the same species.

Agriocnemis ruberrima albifrons subsp. nov., figs. 38-39.

MALE: similar to the nominotypical form in the structure of anal appendages, but with strikingly different coloration. Head: similar to nominotypical form but sides of face yellow instead of green; frons covered with very profuse pruinosity, producing a conspicuous white spot. Postocular spots as in typical form. Legs yellow with black stripes on extensor surfaces of femora. Colours and markings on prothorax and synthorax the same as in typical form, but median lobe on rear edge of prothorax tends to be narrower. Measured across the narrowest part, this lobe is

in typical form	14.5, 16.5, 17 units (1 unit $= \frac{1}{44}$ mm.)	
in *A.r. albifrons*	10.5, 14.5 units.	

Wings hyaline, pterostigma a very distinct dark red (wine red), (buff-brown in typical form). Abdomen: in the typical form the abdomen is entirely red from middle of segment 3 onwards. In *A.r. albifrons* segments 1-8 black dorsally, green on sides; red colour begins on sides of 8; 9 partly black dorsally, otherwise red; 10 and anal appendages red.

FEMALE: very different from the one described in my paper (1961). Head similar to male but without pruinosity and without postocular spots. Prothorax black with light brown markings on sides. Posterior edge in three lobes: the median lobe is the shortest, the laterals protrude further back (fig. 39). Synthorax black above, with olive-brown antehumeral stripes (fig. 38). Dark band along humeral suture rather indistinct and not equally

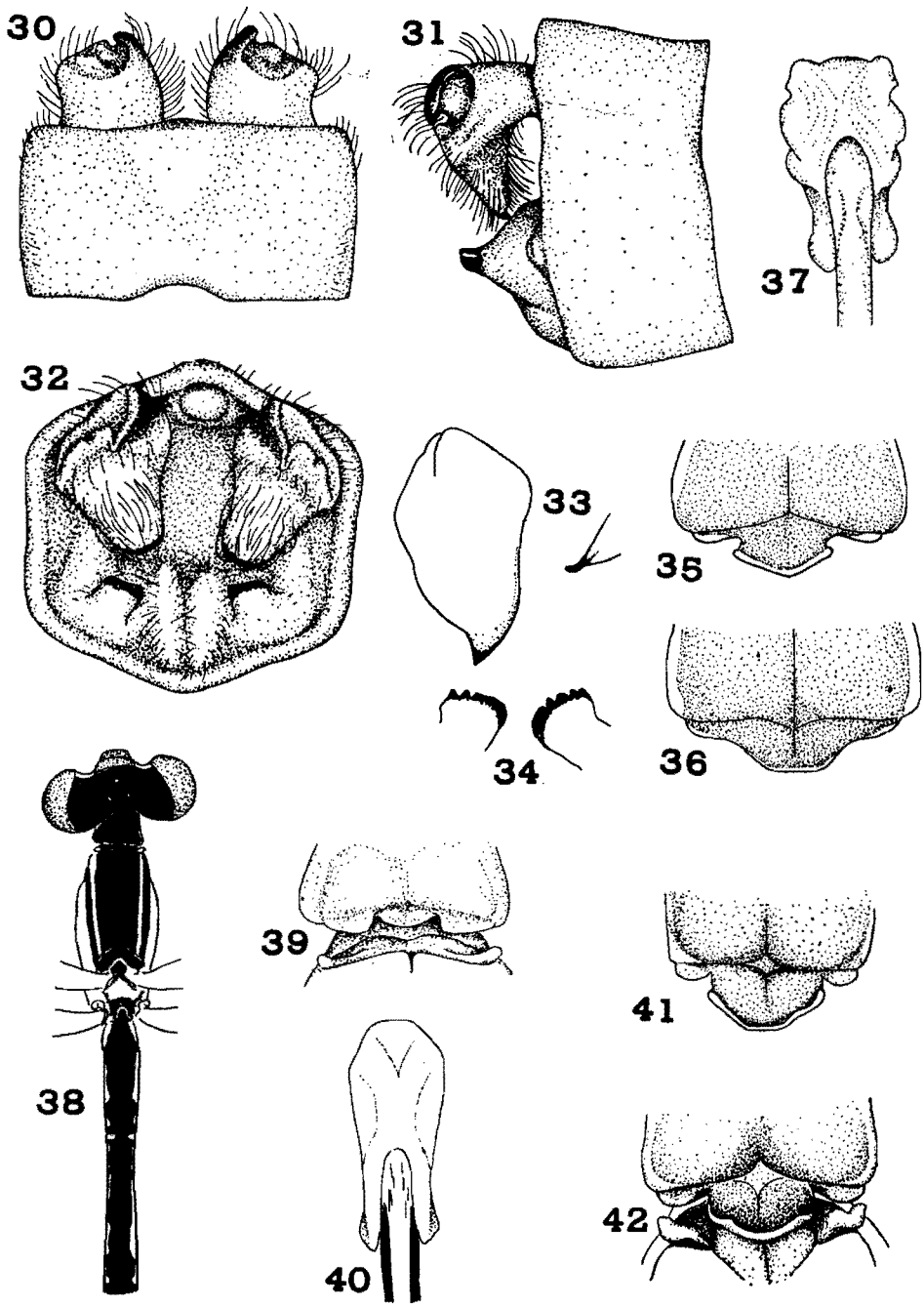
developed in all specimens. Sides of thorax ventral to 1st lateral suture-green. Pterostigma buff-brown. Abdomen black dorsally, green (segments 1-7) or brownish (segments 8-10) laterally.

REMARKS: The differences between the Richard's Bay and the Okavango populations, inasmuch as this concerns the males cannot be altogether due to the Okavango males being more mature: of five ♂♂ collected at Richard's Bay at least two were fully coloured. The difference in females suggests that the female described as that of *A. ruberrima* may not have been conspecific with the males. In Okavango there was only one type of male and one type of female present, and it is very likely that the two males and the five females captured are conspecific. In Richard's Bay there were two species found in the same locality: *A. ruberrima* Balinsky, and *A. exilis* Selys (interpreted as above, p. 246). Furthermore, *A. gratiosa* Gerst. is also known to occur in Natal (Pinhey, 1958, also collected by myself on Pongola River and at Richard's Bay, though in a different area) and it is my opinion now that the female described in my paper as that of *A. ruberrima* might have been a female of *A. gratiosa*, with which it has a general similarity in appearance, shape of prothorax and size. The female of *A. ruberrima albifrons* described above would then be the first female definitely belonging to this species, though not to the typical form. From the above description and drawings it will be seen that it is very similar to the female of *A. exilis*. In fact I have not been able to find any distinction between these forms in the female sex.

♂ - Holotype: Okavango Swamp (Bechuanaland), 19.IV.1962, ♀ - allotype, same locality and date, in coll. Transvaal Museum. Paratypes (one ♂, four ♀♀) in author's collection from same locality, IV.1962.

EXPLANATIONS OF FIGURES

Fig. 30. *Agriocnemis pinheyi* spec. nov. Anal appendages, dorsal view.
Fig. 31. Same, view from left.
Fig. 32. Same, posterior view.
Fig. 33. Left superior anal appendages of *Agriocnemis falcifera* Pinhey in posterior view, and tip of appendages in lateral view.
Fig. 34. Inferior anal appendages of *A. falcifera* Pinhey, posterior view. (Figs. 33 and 34 drawn from Pinhey's paratype).
Fig. 35. *A. pinheyi* spec. nov. Prothorax of ♂.
Fig. 36. Same, Prothorax of ♀.
Fig. 37. Same, Penis.
Fig. 38. *Agriocnemis ruberrima albifrons* subsp. nov. ♀.
Fig. 39. Same ♀, prothorax and mesostigmal lamina, higher magnification.
Fig. 40. *Agriocnemis angolense* Longfield. Penis.
Fig. 41. Same, prothorax of ♂.
Fig. 42. Same, prothorax and mesostigmal lamina of ♀.



			Post nodal cross veins	
	Abdomen	Hindwing	Forewing	Hindwing
♂♂	16 mm	9.5 mm	6 — 8	5 — 6
♀♀	15 — 16.5 mm	10 — 10.5 mm	7 — 8	6 — 7

Agriocnemis angolense Longfield, 1947, figs. 29, 40-42

The species has been described from Angola. On 3.XI.1960 Mr F. Gaerdes collected a number of males and females of this species on the Okavango River at Andara (S.W. Africa). Longfield's description fits the S.W. African specimens very well; I am able, however, to add a few points which have not been mentioned in the original description.

In the genus *Agriocnemis* the shape of the posterior edge of the prothorax appear to be an important character, and is, so far, the only reliable feature for distinguishing the females, in view of the variability of coloration, especially of the existence of homochromatic and heterochromatic forms. Longfield (l.c.) does not mention this character at all, I therefore include here drawings of the prothorax of the male (fig. 41) and the female (fig. 42). This is rather similar in the two sexes: the posterior edge is subdivided by deep incisions into three lobes; the median lobe is large, almost semicircular, with upturned edge, narrowly fringed with yellow in the males, with light brown in the females. The lateral lobes are smaller, rounded, with bluish spots on lateral edge in males, mostly light coloured, except the medial end, in females. The lateral lobe of the mesostigmal lamina in the female with high reddish-brown ridge; laterally the ridge is inflected forwards. Longfield does not make it clear that the superior anal appendage of male actually consists of two distinct lobes: a more obvious and longer lobe stretched out horizontally, and a lower and shorter lobe ending in a comb of black denticles. The upper lobes are attached by an attenuated stalk, and break off easily. Without them the tip of abdomen bears a distinct resemblance to that of *A. ebneri* Ris, 1924, but the present species can then be distinguished by the abovementioned serrated comb, which takes the place of the ventrally directed hook of *A. ebneri.*

The wings in the males, but not in the females present a very peculiar feature, not noted by Longfield, and not found, to my knowledge, in any other *Agriocnemis,* namely: the edge of the hindwing is broadened at the pterostigma and covered here by dense bluish pruinosity. Lastly, I include a drawing of the penis (fig. 40); I find that the incision between the lobes is somewhat deeper than shown by Longfield.

Genus *CERATOGOMPHUS* Selys

Ceratogomphus triceraticus spec. nov., figs. 43-45

Similar to *C. pictus* (Hagen) Selys, but darker, larger and with a different structure of the superior anal appendages.

MATURE MALE: Pattern on head similar to *C. pictus*, but the black lines and areas broader, with diffuse edges, the light colour is darker, brownish, without the greenish shade in life. Thorax with the same general pattern as in *C. pictus*, but light colour brownish with only a slight touch of olive; the dark bands with diffuse edges, much broader, with a tendency to fuse with each other and so interrupt the light coloured bands; in particular there is a distinct cross-connection between the dark bands on the 1st and 2nd lateral sutures, behind the metastigma. Sides of thorax, especially the black bands covered with a thick bluish pruinosity. Legs brownish, femora with black lines both on medial and lateral surfaces. Wings with black venation, with only a scarcely perceptible tinge of olive; a touch of brown

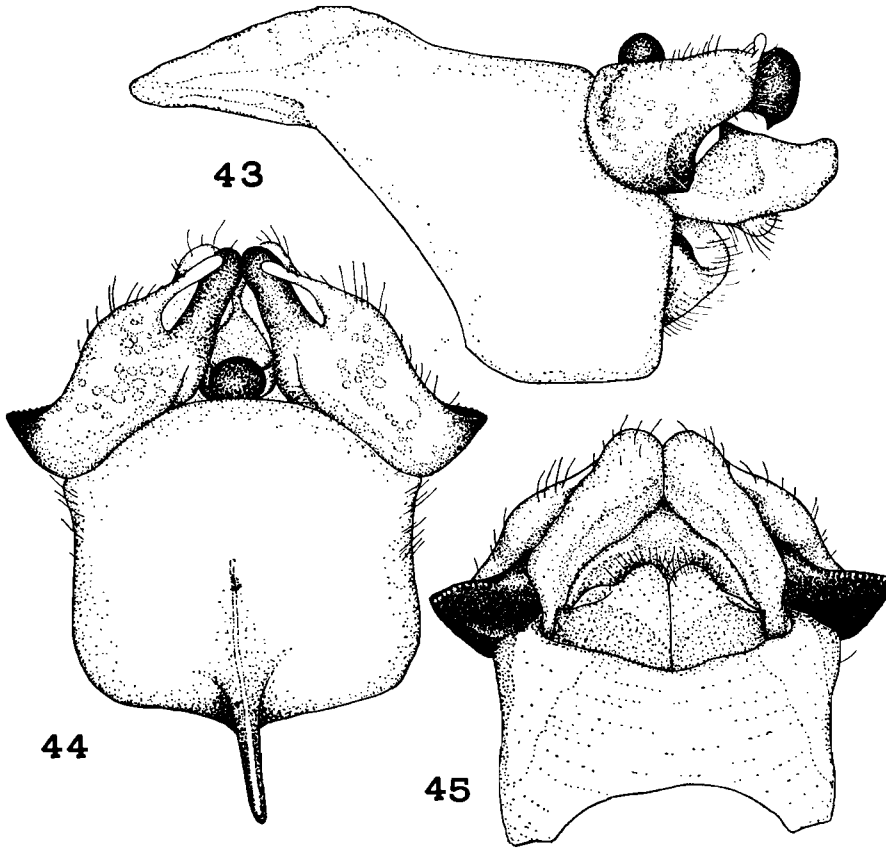


Fig. 43. *Ceratogomphus triceraticus* spec. nov. 10th segment and anal appendages, view from left.
Fig. 44. Same, dorsal view.
Fig. 45. Same, ventral view.

at base between Sc. and R. on each wing; pterostigma black. Abdomen with the black pattern more developed and the light colour darker than in *C. pictus*. Sides of segment 1 and 2 with pruinosity.

Superior anal appendage (figs 43-45), as in *C. pictus*, bifid, consist of a massive proximal part and two terminal branches: an inner strongly sclerotized branch, ending in a head with a ventrally directed sharp tooth, and an outer branch, which is much thinner, and soft. The lateral edge of the proximal part is strongly sclerotized and serrated, and protrudes laterally in an angle, which is sharp and acute in *C. triceraticus* but blunt and more or less rounded in *C. pictus*. The greatest length of the proximal part of the superior anal appendage measured from the lateral angle to the point of bifurcation is distinctly greater (almost twice as great) as the length of the distal branches; in *C. pictus* it is ± equal to the length of the distal branches. The supra-anal lobe, protruding dorsally between the bases of the superior anal appendage is rounded posteriorly; in *C. pictus* it bears a distinct vertical indentation on posterior surface.

FEMALE: unknown.

Abdomen 45 mm, hindwing 33-34 mm, pterostigma 4 mm.

♂ - Holotype: Great Berg River, near Franschhoek, (C.P.), 21-I-1962, collected by author, in coll. Transvaal Museum; ♂ - paratype, same locality and date in author's collection.

REMARKS: More specimens of the same kind were seen in the locality, but could not be captured. In flight the insects appear to be very dark. On close examination the acute angles of the superior anal appendages are very conspicuous, as two horns protruding laterally and matching the dorsal horn of the 10th abdominal segment — hence the name proposed for the species.

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